Structure of Mix in a Rayleigh-Taylor Unstable Fluid Cell

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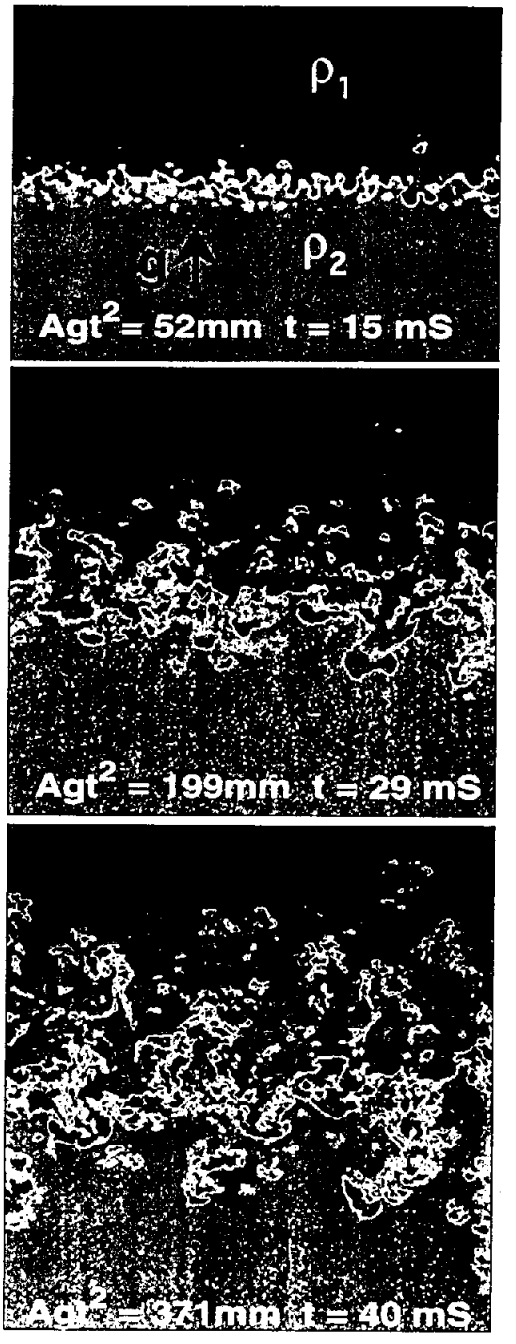

The mix structure in a constant-acceleration Rayleigh-Taylor unstable fluid cell containing two immiscible liquids has been observed and measured. The cell is accelerated to 70 times earth's gravity using the LLNL Linear Electric Motor (LEM)[1]. An image of the interfacial instability in a plane perpendicular to the interface is obtained with the Laser-Induced Fluorescence (LIF) technique. A statistically robust definition of bubble and spike penetration distances are defined from the two-dimensional processed image. The bubble penetration, the spike penetration, the length of the interface, and the amount of mixed fluid all scale linearly with the generalized displacement of the cell, Agt^2, where $A = (\rho_2 - \rho_1)/(\rho_2 + \rho_1)$, and $\rho_2 > \rho_1$. However, the width of the mixed structures do not have a characteristic size, but all lengthscales from ~ capillary length up to a maximum lengthscale are present. This maximum lengthscale is not well-defined, but it increases with the generalized displacement. In addition, the presence of turbulent mix can be easily diagnosed with a simple calculation of effective dimension.

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1 Guy Dimonte, et al., Rev. Sci. Inst. 67, 302 (1996); Phys Rev E (in press, Oct. 1996)